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AUTHOR Wagner, Gregory A.: Morris, Edward K.
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ABSTRACT

This paper examines the acquisition of superstitious behavior in young children. Six preschool children were exposed to a 15 minute fixed-time inter-reinforcement interval (FT-15") schedule while another six preschoolers were exposed to a 30 minute fixed-time inter-reinforcement interval (FT-30") schedule. In a free-operant laboratory setting, a mechanical clown delivered marbles, which the children could later trade for toys, according to one of the two schedules. All sessions were videotaped and scored for particular superstitious behaviors (for example, touching the clown and making faces). Since no differences emerged as a function of FT interval length, all twelve children were grouped for analysis. One third to one half of the twelve children showed evidence for acquistion of superstitous behaviors: four children showed some dominant behaviors but it was not possible to clearly ascribe the word superstitous to them and three children showed extremely low frequencies of any particular behaviors. An independent assessment of reinforcement effectiveness was conducted, and inter-observer reliability was provided. (Author/MP)

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Acquisition of Superstitious Behavior with Children

Gregory A. Wagner and Edward K. Morris

University of Kansas

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Acquisition of Superstitous Behavior with Children

Although this paper session is focused on "unusual contingencies", I will describe research that I submit, involves a contingency that is not so unusual. The contingency in question is that of adventitious reinforcement, in which there exists no dependent relation between a response and the reinforcing events that follow it. The reinforcer is simply temporally contiguous with ongoing behavior. In that a large portion of everyday events in an organism's life occur independently of behavior, this contingency is not unusual. If these events are functional as reinforcing stimuli, then they inevitably exert control over responding.

In 1948, Skinner (1948) found that food deprived pigeons developed stereotyped responding when grain was delivered on a response independent Fixed Time 30" (FT-30) schedule. His analysis of this phenomenon followed the logic of operant conditioning: the periodic response-independent delivery of a reinforcer adventitiously strengthens behavior which is then more probable in the future, and concomitantly more likely to be further strengthened by subsequent adventitious reinforcement. The phenomenon described by Skinner became known in behavior analysis as "superstitious" behavior. As for its applied significance, the phenomenon has been related to such human behaviors as individual styles, preferences, and aversions (Herrenstein, 1966).

Following Skinner's initial demonstrations, other researchers have pursued research on superstitious behavior (e.g., Edwards, West, & Jackson, 1968; Killeen, 1978; Staddon & Simmechag, 1971; Zeiler, 1968; 1970; 1972). All of them, however, have had to face two problems inherent in the investigation of superstition. First, the superstitious behavior which eventually emerges is unknown prior to applying the adventitious contingency. Second, since no formal response is required, the behavior which does emerge is free to drift in topography. Because of these two problems, behavioral observation

systems have been difficult to develop and implement for documenting the acquisition of superstitious behavior. In attempts to circumvent the problems, most researchers proceed by developing a dominant response via standard response-dependent schedules, and then shifting the subjects to response-independent schedules. These procedures have typically revealed the maintenance of responding during the adventitious schedules above comparable extinction conditions in both infrahumans (e.g., Neuringer, 1970; Rescorza & Skucy, 1969) and humans (e.g., Catania & Cutts, 1963; Hollis, 1973; Weisberg & Kennedy, 1969; Zeiler, 1972). While these demonstrations of response maintenance are noteworthy, they do not contribute to our understanding of how behavior may be superstitiously acquired. Little research has actually been conducted on acquisition, all of which has been limited to rats (e.g., Davis & Hubbard, 1972), pigeons (e.g., Fenner, 1980; Staddon & Ayres, 1975; Staddon & Simmelhag, 1971), and hamsters (e.g., Anderson & Shettleworth, 1977). In these studies, as many as 16 responses were recorded simultaneously, and it is interesting to note that interobserver reliability has never been reported.

The purpose of the two experiments I will describe today is to provide for the first time a demonstration of the acquisition of superstitious behavior with human subjects. In addition, we established independently the function of our reinforcing stimulus, and also provided interobserver reliability. In Experiment 1, we examined the effect of an FT-15" schedule; in Experiment 2, we examined an FT-30".

Method

Subjects

In each of two experiments, six preschool children -- three boys and three girls -- served as subjects. The mean ages of the children for the respective studies were 4.6 and 4.7 years.

Setting and Apparatus

All sessions were conducted in a 2 x 2.5 m experimental room. Both studies were conducted in two parts. First, we examined acquisiti n of super-stitious behavior. Second, we assessed the function of our reinfo cing stimulus. During the response-independent phase, two pieces of equipment wer located against one wall of the room. (1) On the left-hand side was locat d a board on which was mounted a clear plexiglas box into which children pla ed marbles, and a shelf on which was placed a toy for which the marbles were t aded. (2) In front of the child was a large mechanical clown which dispe sed marbles from its mouth onto a plexiglas tray. On the tray were angled run ers down which each marble traveled, thereby providing a limited hold for m rble, accessibility ($\bar{x}$ time = 3.6"). If a marble was not picked-up by th child during this time, the marble dropped into a lower compartment, and was then inaccessible to the child. Hence, a consummatory response was req ired. Video tape equipment was used to record all child behavior. In Ex eriment 1, the camera was located behind a one-way mirror separating the expe imental room from an observation room; in Experiment 2, it was located in he experimental room on a small table to the child's right.

Later, during the assessment of reinforcer effectiveness, the board described previously remained located to the child's left; a small table was located directly in front of the child, on which was a lever wh ich pro-duced marbles when pressed; and the clown was located to the child s right. Reinforcement delivery was programmed via standard electromechanica l equipment from an adjacent observation room.

Experimental Procedures

As mentioned, the only difference between Experiments 1 and 2 was the fixed-time inter-reinforcement interval -- 15" in Experiment 1, and 30" in Experiment 2. All other procedures were identical.

Response-independent condition. Two baseline sessions were conducted for each child. Both lasted approximately eight minutes. During this time, no marbles were delivered. Following baseline, six 10-minute FT sessions were conducted during which marbles were delivered independently of ongoing behavior. The clown's nose lit-up three seconds prior to the marble delivery. Two final baseline sessions were conducted in a manner identical to the first two.

All sessions were videotaped while the child was alone in the room. Prior to each session, the child selected a toy for which the marbles were traded. Enough marbles were to be placed by the child into his or her box to come up to a criterion level. The instructions provided each day were:

> "The clown is our friend named 'Bobo'. Sometimes Bobo will give marbles, and sometimes Bobo won't give marbles. Bobo wants you to get each marble and put it in your box. If you don't get the marble, it will drop into the bottom of the box, and you won't be able to get the marble." (These events were demonstrated.) "When you catch each marble, you must put it in your box. Then, if you get enough marbles to come up to the line, you can trade them for your toy."

Response-dependent condition. After the response-independent phase was completed, four daily sessions of reponse-dependent reinforcement were conducted to demonstrate that the marbles were functioning as reinforcers. In this phase, the children lever-pressed for marbles, which the child placed into his or her box to trade for a pre-selected boy. Two sessions of CRF were run, followed by two sessions of FR2 or FR3. During each session, 20-40 marbles were delivered, followed by four to five minutes of extinction. A cumulative recorder provided records of each session. The instructions provided each day were:

> "Sometimes when you press this bar, Bobo will give marbles. Sometimes though, Bobo won't give marbles. Bobo quits. If you can get enough marbles in your box, you can trade them for your toy."

Observation Procedures

Behavior scoring. For the response-independent phase, narrative data

sheets were used initially to note what behaviors appeared to emerge as dominant across sessions. Then, the videotapes were observed, and the responses scored on an Esterline-Angus event recorder. These data were then transferred to a one-second interval data sheet for analysis of response-reinforcer temporal distributions, as well as mean time of occurrence for each response, calculated across sessions. For subjects who failed to display any recurring behavior across sessions, their videotapes were scored for all of the specific responses observed of the other children.

Interobserver reliability. Interobserver agreement was calculated by having a second observer randomly score a third of all sessions across children. Reliability was calculated for (1) total occurrence and nonoccurrence; (2) occurrences by individual 15" or 30" intervals; and (3) occurrences by one-second intervals with a sliding rule of 1". The first reliability measure -- total occurrence and nonoccurrence -- yielded a mean score of 98.6%. Occurrence by 15" or 30" intervals was 80%. Finally, occurrence by one-second intervals was 81.2%.

Results

No differences emerged as a function of FT interval length, thus all twelve children were grouped for analysis. Within this group may be discerned three subgroups: (1) Four children showed clear acquisition of superstitious behavior across sessions; in this group, response probability increased prior to marble delivery. (2) Five children developed some dominant behaviors during the FT sessions; however, the behavior patterns were not orderly, and hence, the ascription of "superstitious" behavior may be unwarranted. (3) And three failed to display any dominant behavior during the FT sessions; this held even when the tapes were scored for the behaviors observed of all other children.

Illustrative subjects falling into the three categories are presented in Figures 1 and 2. Figure 1 presents second-by-second response probabilities -- response frequency divided by the total number of trials in a session -- as a function of post-reinforcement time. A weighted mean time of occurrence is provided above each session in which responding occurred. No responding was observed for any of the children during the first two baseline sessions. Subject 1, from the FR-30" condition, began smiling in the first reinforcement session. Probability was highest in the early part of the 30" inter-reinforcement interval for sessions 3 and 4, shifting over the final four reinforcement sessions to later in the interval. A return to baseline resulted in relatively flat functions and slightly decreased rates in the final two sessions. Subject 2, from the FT-15" condition, began making faces in the first reinforcement session. By the second reinforcement session, probability shifted from a flat function, to a peak toward the end of the 15" interval. This shift held for all reinforcement sessions with the exception of Session 7, in which responding declined. No responding occurred in the final baseline condition. The behavior of these children is much like that of the other two who evidenced superstitious behavior. Subject 3, from the second subgroup which exhibited no orderly behavior patterns, began touching the clown's face in Session 3, with a distinct U-shaped function across the 15" interval in sessions 4 through 6. No responses, however, were observed in the final two reinforcement sessions, and a flat function, with comparable rates, represented the first session of Baseline II. Finally, Subject 4, from the group which exhibited no clear increases in behavior, showed minimal frequencies of both making faces and touching the clown's face. Probabilities for both responses were summed, peaking toward the end of the 15" interval, but frequencies for either behavior alone were extremely low across sessions.

Figure 2 provides the respective percentages of total responses per session, fo thirds of the inter-reinforcement interval. These graphs parallel the probabi ities presented in Figure 1 for the four previously described subjects.

Figure 3 presents cumulative records of lever pressing for all four children du ing the reinforcer assessment phase of the study. Though extinction of lev r pressing rarely occurred immediately following cessation of marbles, th rates during CRF or FR2 were typically much higher than during extinction, indicating that the marbles functioned as reinforcers. By the second or t ird session, all children stopped pressing at some point during extinction.

Discussion

The re ults indicate evidence for acquisition of superstitious behavior for a third to half of the twelve children. The behaviors varied across these child en, and typically a single response emerged as dominant. Though frequencies were somewhat low, probabilities increased in an orderly fashion across the nter-reinforcement interval. That some children showed no orderly patterns or no dominant behavior should not be surprising given that other research, b th with humans and infrahumans, has failed to yield superstitious behavior in every subject (e.g., Davis & Hubbard, 1972; Skinner, 1948). Also, some childr n reached asymptotic responding in early or mid-reinforcement sessions, w th a subsequent decline in responding over sessions. Such has been found nd discussed by other investigators as a case of "drift" in the behavior (e g., Fenner, 1980; Herrenstein, 1966; Skinner, 1948).

Future considerations in this area of research should include the possibility of adjunctive behavior. Recent research has found that response-independent schedules produce behavior that rarely precedes the reinforcer closely in t ime. Because of this, the law of temporal contiguity or notions

of response chaining have been viewed as inadequate to account for the behaviors produced. These "interim" or adjunctive behaviors occur during periods of low reinforcement probability, whereas "terminal", superstitious behaviors occur during periods of high reinforcement probability (Staddon & Simmelhag, 1971). Interim behaviors have been observed with both infrahumans (e.g., Falk, 1977; Fenner, 1980; Staddon & Ayres, 1975) and humans (e.g., Frederickson & Peterson, 1974; Kackanoff, Leveille, McClelland & Wayner, 1973; Muller, Cross, & Cheney, 1979; Wallace, Wayner, & Cook, 1974) and have been related to human obsessions and general "time-filling" behavior. Although no children in the present studies showed behaviors occurring primarily in the early part of the FT interval, interim behaviors could be induced as a function of such procedures. The addition of response manipulanda, toys, or other children might increase the likelihood of adjunctive behavior.

One other direction for future research which we will be pursuing is to examine instructions designed to affect the probability of superstitious behavior (i.e., instructions indicating that reinforcers are response-independent or -dependent).

Acquisition of superstitious behavior with humans is an important area for research. More is needed, and several directions -- some of which were outlined here -- lie open for experimental investigation.

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Figure Legend

Figure 1. Response probability (frequency divided by number of trials) as a function of post-reinforcement time in seconds. Weighted mean time of occurrence is provided above each graph in which responding occurred.

Figure 2. Percentage of total session responses occurring in thirds of the inter-reinforcement interval.

Figure 3. Cumulative responses on CRF and FR2 or FR3. Two sessions for each subject are represented, and in each session a reinforcement condition was followed by extinction (i.e., where pips on the record end, extinction begins).

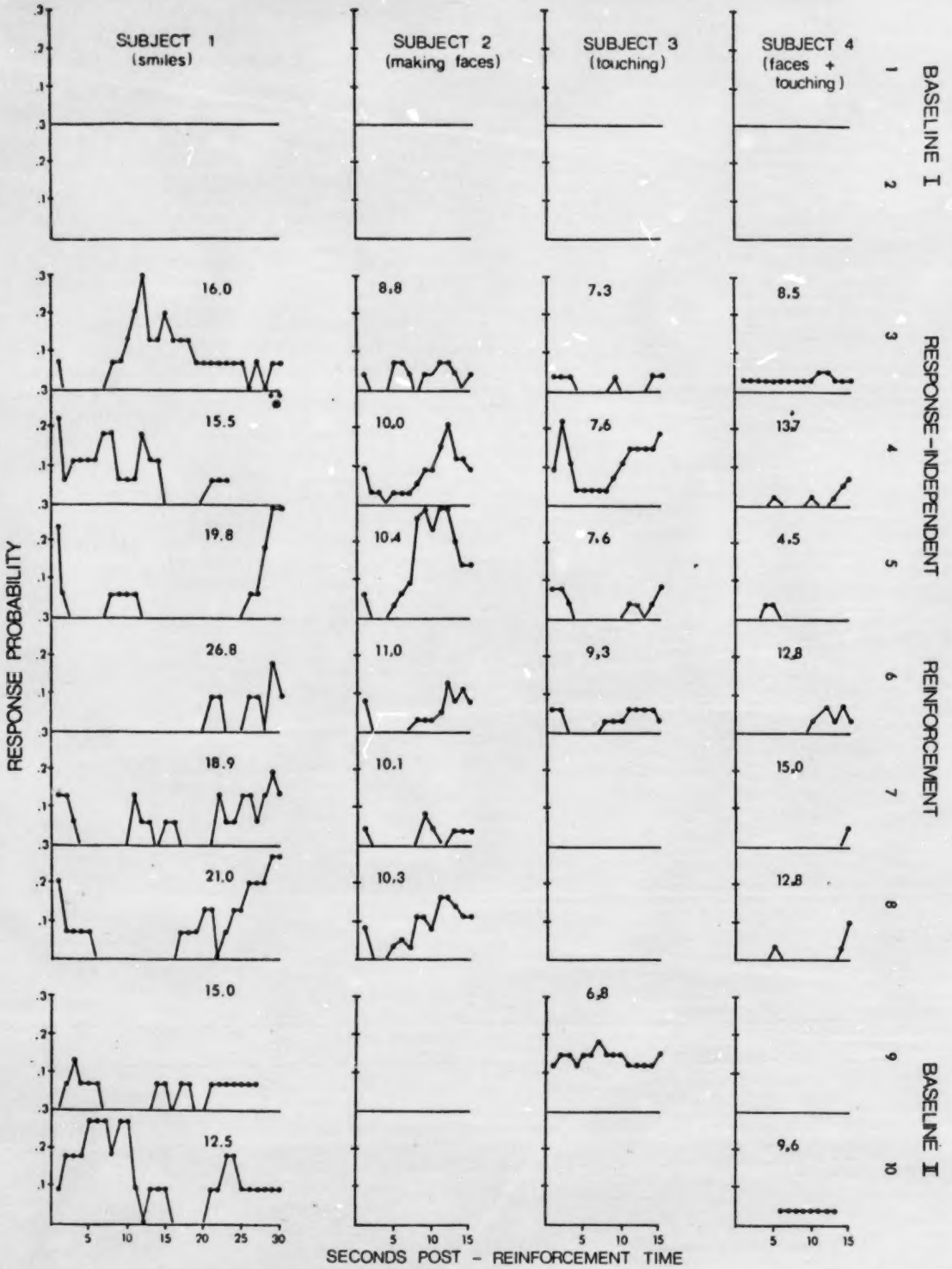

FIGURE 1

*(THE RESPECTIVE VALUES FOR THESE TWO POINTS ARE .41 AND .53)

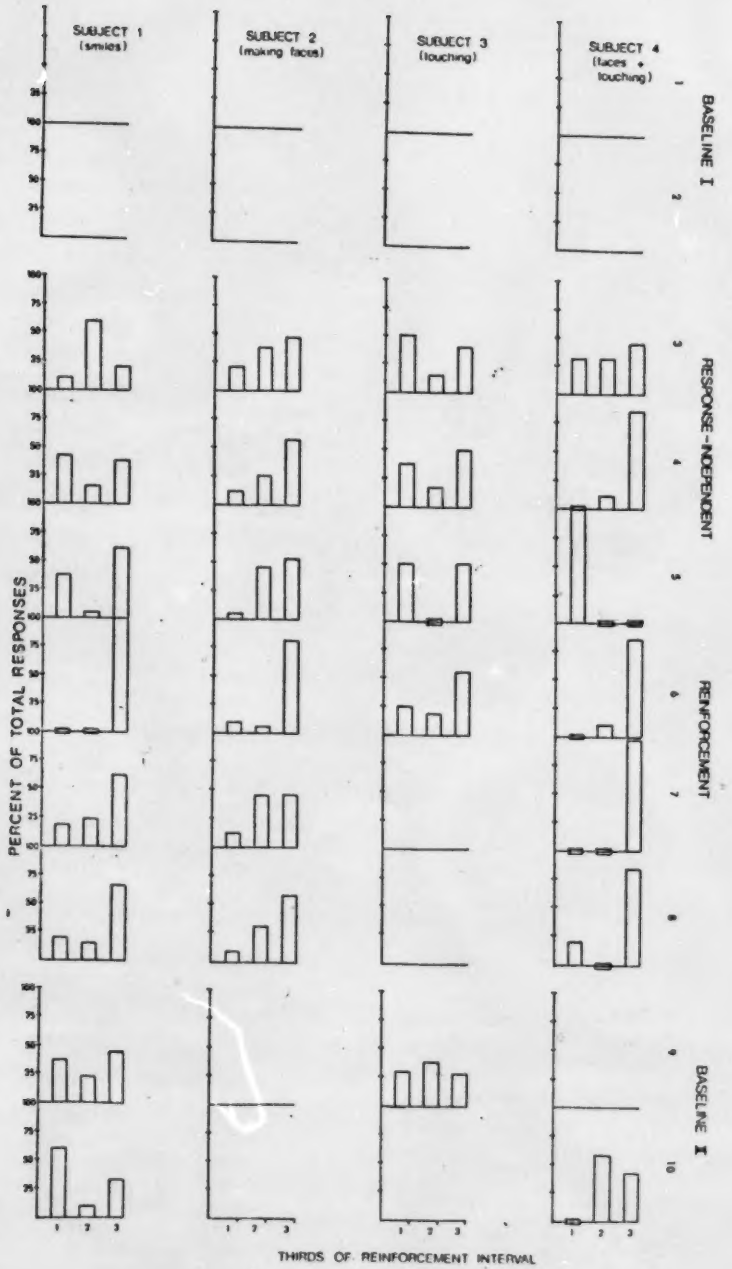
SUBJECT 1
(smiles)
SUBJECT 2
(making faces)
SUBJECT 3
(touching)
SUBJECT 4
(faces + touching)
BASELINE I
RESPONSE-INDEPENDENT REINFORCEMENT
BASELINE II
PERCENT OF TOTAL RESPONSES
THIRDS OF REINFORCEMENT INTERVAL

FIGURE 2

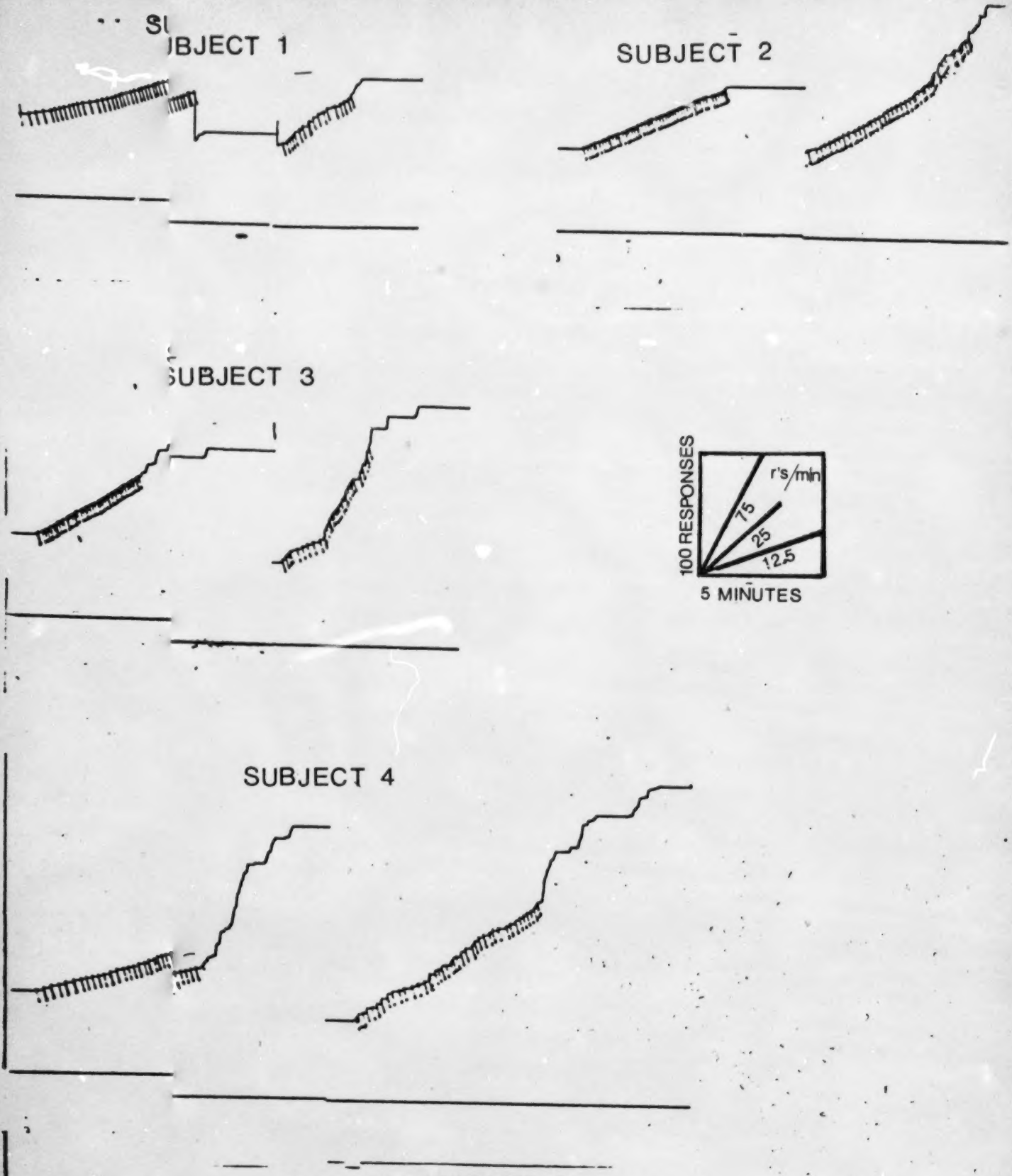
SUBJECT 1
SUBJECT 2
SUBJECT 3
SUBJECT 4
100 RESPONSES
r's/min
75
25
12.5
5 MINUTES

FIGURE 3